

STUDIES ON SPAWNING MIGRATION AND SPAWNING OF HILLSTREAM FISH *DISCOGNATHUS MULLYA* (SYKES)¹

G. LOVIAH JOSEPH² AND S. V. JOB³

(With a text-figure)

INTRODUCTION

Migration of fishes from their native habitat prior to spawning to another area, which may offer favourable conditions for spawning, and their subsequent return to their original home has been recorded in many riverine forms (Cadwallader 1976), and first migration of *Discognathus* was reported by Hora (1921). An excellent account of the prespawning migration of *D. mullya* was given by Jones (1941), who observed the migration of this species in the Kallar river of Western Ghats in Peermedu Taluk, Travancore.

In this study the migration of *D. mullya* was investigated in a hillstream called Ulakkaruvi, situated at an altitude of 1255 m above MSL in the southern slopes of Western Ghats in Ashambo hills of Kanyakumari District, Tamilnadu. This hillstream has two major water falls—upper and lower, several pools and rapids.

MATERIAL AND METHODS

An area of approximately 1 Kilometre from upper falls down to the lower beds of the Ulakkaruvi stream, embracing several pools

and rapids was taken up for study. The area taken for observation was divided arbitrarily into three major zones (Fig. 1) for convenience and the study was carried out from November 1977 to March 1978. The area of the upper falls lying at an elevation of 614 m above MSL has two major pools and ten rapids, called zone A, while the lower falls (537 m above MSL) and area around it including a side stream constituted zone B. In this area, there are five medium sized pools and nine rapids. Zone C consisted of the lower reaches of the main stream lying at an elevation of 502 m above MSL. Here there are three pools one major and the other two medium sized, and five rapids.

Preliminary investigations were carried out in the laboratory to find out a suitable marking method on the fish so that they could be easily identified on recovery. Tagging (plastic) of either the operculum or fin was found to be unsuitable, since the tagged fishes behaved abnormally, and there was considerable mortality. This method was abandoned and a group marking technique (Nikolsky 1963, Brian Stott 1971) was adopted. Group marking is performed either by painting or branding the fish, or by cutting part of the fin, was found to suit well for *Discognathus* and hence this method was employed, and the following procedure was followed in the field.

Fishes were captured in the early hours of the day (8 a.m.), and those with length range

¹ Accepted December 1980.

² Scott Christian College, Nagercoil-629 003, Kanyakumari Dist., India.

³ School of Biological Sciences, Madurai Kamaraj University, Madurai-625 021, India.

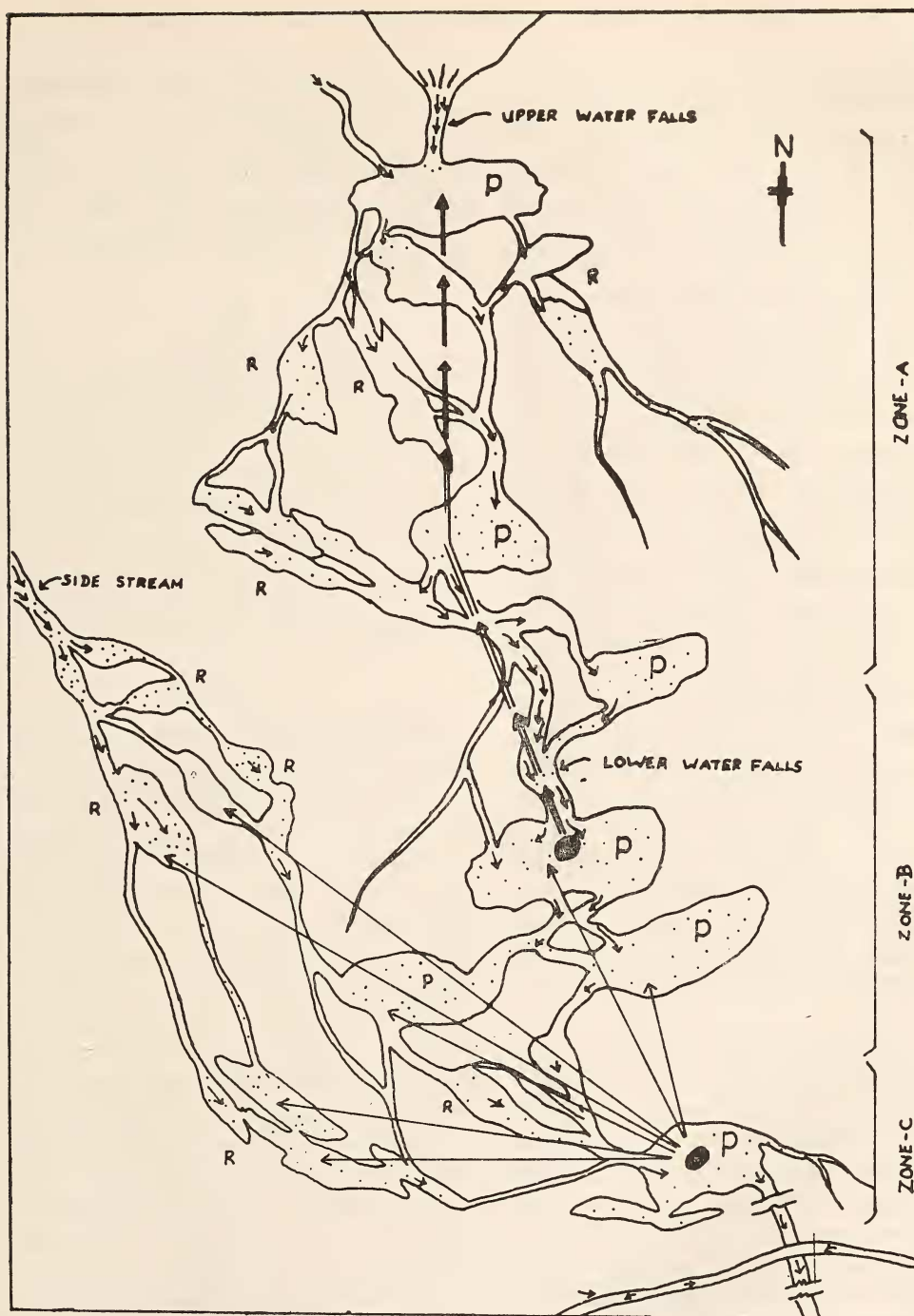


Fig. 1. Showing a section of the Ulakkaruvi stream probed in migration studies.

P — Pools

R — Rapids

Arrows radiating from the pool at Zone-C indicate the direction and areas of prespawning migration.

Arrow from pool at Zone-B towards Zone-A indicate the direction of post-spawning migration.

Small arrows inside the pools and rapids show the direction of the flow of water.

55 mm and above were only taken for study. The netted fishes were released in net cages (3 x 1 m) kept half submerged in a pool. From this sample the fishes were taken individually in a small hand dip net; its length was measured and the dorsal lobe of the caudal fin was spread and the postero-dorsal edge (> 3 mm) was clipped off. On the amputated surface methylene blue solution was rubbed using cotton. The marking was done as rapidly as possible and the marked fishes were released in another net cage kept half submerged in the same pool. The amputation of very small portions of the caudal fin caused no change in the mobility of the fish and the time lag between their release and recovery was too short for full regeneration of the cut portion. All the marked fishes were allowed to swim inside the net cage for a period of four hours. The stain lasted for a few hours and in many cases it faded off. Any fish which showed abnormality in mobility was isolated and not used in the study. All the other fishes were released in the major pool at zone C around 3 p.m. Following the above modalities fishes were captured and released on five occasions (20th, 22nd, 25th, 28th November and 2nd December 1977) in zone C and a total of 293 fishes were released. As there was no sexual dimorphism in *D. mullya*, the sex of the released fishes could not be ascertained.

To find out the possible presence of any early migrants from the lower beds (zone C) of the stream to the upper reaches (zones A & B), intensive netting was done in these latter areas at regular intervals from 7th December to 30th January 1978. Only accessible pools and rapids were searched for the marked fishes, while a few pools located in the steep (35 m) slippery part of the main stream could not be probed due to their inaccessibility. If any marked fish was caught, after measuring its length,

a small mutilation was made on the inner margin of one of the pelvic fins and it was released again. This had to be done to identify the recaptured from other marked fish. Fishing was done in areas beyond zone C also to find out any possible downward movement of the marked fishes.

RESULT

The number of fishes captured with their size range and the number of them marked and released are given in the Table I. The percentage of recapture was rather low (17.06%) and this was due to the different terrain and uneven topography of the area where no standard netting device could be employed. Another difficulty faced was the inaccessibility of a few pools lying on the main stream.

DISCUSSION

Though the total percentage of recapture in migration study (17.06%) was low, it fairly reflects the mode of migration of *D. mullya* at Ulakkaruvi. From the place of recapture of marked fishes it can be inferred that these fishes ascended from Zone-C climbing along the 35 m high slippery rocky terrain to the rapids and pools present around the base of the lower falls and side stream. Thus their movement was against the current. Intensive movement of fishes were observed on 18th January 1977 at dawn among the rapids and pools of the side stream and spawning of the fishes was observed in a rapid, and eggs were collected immediately after spawning and thereafter (vide spawning). From the dates of recovery of marked fishes, observation of spawning and subsequent egg collection, it is reasonable to assume that *D. mullya* might have undertaken a prespawning migration from the last week of December 1977 to the second week of January 1978.

TABLE I
NUMBER OF *D. mullya* RELEASED AND RECOVERED IN MIGRATION STUDIES

Length Range (mm)	Number of fishes and dates on which release was done in Zone-C 1977							Total number of fishes released in Zone C	Dates and number of fishes recovered from Zone B			Total number of fishes recovered in Zone B in Zone B	Number of fishes recovered in Zone A between 25th March and 10th Apr. 1978	Total % of recovered fishes from Zones A & B	
	1977								1978 Jan.						
	Nov 20	Nov 22	Nov 25	Nov 28	Nov 28	Dec. 2	Dec. 28		7	13	15				
55 — 60	11	13	7			2	33		2	1		3	2	15.15	
61 — 65	2	9				6	17		2	1	4	7		41.18	
66 — 70	5		40	11		30	86						4	4.65	
71 — 75	18	9		27		10	64		2	6	1	9		14.06	
76 — 80		20				2	22		1		4	5	8	59.09	
81 — 85	16	3	8				27			1		1		3.70	
86 — 90	2	6	4	3			15		1	1		2		13.33	
91 — 100		7	1	13			21						5	23.81	
101 — 105	3	1				4	8			3	1	4		50.00	
TOTAL:	57	68	60	54	54	54	293		4	3	17	7	31	19	17.06
													(10.58%)	(6.48%)	

In the month of March 1978, the water level in most of the pools and rapids dwindled and adult fishes were scarcely seen. In order to find out whether these fishes ascend further upward, undertaking a post-spawning migration, fishing was done on several occasions (25th, 28th, 30th March and 5th, 7th and 10th April 1978), in the major pool lying at the base of the upper falls, 19 marked fishes (2 previously captured) were recovered during this intensive probing. This recapture emphasizes the fact that *D. mullya* undertakes post spawning migration when the water level in their breeding grounds goes down to a precarious level. Though water level had gone down and most of the rapids and pools were cut off without any water flow, the pools and rapids were full of larval fish in various stages of development. Several observations made by Jones (1941) may be pertinent in understanding the migration of *D. mullya*. While observing the prespawning migration of these fishes in Kallar stream of Western Ghats in Peermade Taluk, Travancore, he stated that the migration 'does not seem to have any relation to rain, as no rainfall had been recorded in this area for over 2 months'. Around Ulakkaruvi stream too there was little or no rainfall during the breeding month.

Spawning:

The first spawning at Ulakkaruvi was observed in the early hours of 18th January 1978 in a rapid, where the temperature of the water was 19°C while that of the atmosphere was 20° ± 1°C. Small shoals of *D. mullya* moved in pre-spawning period mostly from the main stream and pools to the rapids which hardly had a depth of 750 mm, where water flows over slowly. The bottom of the rapids was filled with an admixture of sand and mud, gravel and small boulders measuring less than 500 mm in size. The entire bottom had abundant detritus.

It was group mating, where some 15 to 20 fishes took part. Courtship behaviour involved movements such as following, chasing, and butting which appeared again and again during which extrusion of ova was clearly visible, but shedding of sperm was not observed. Eggs were shed in the water in staggering quantities and simply left to the mercy of the environment. A noteworthy feature was that the fishes were not scared by the presence of the observer.

One odd thing about *Discognathus* during spawning was that they were often found to move in groups underneath boulders. The whole process took place up to 8.30 a.m.; by that time most of the eggs were shed and their haphazard movements almost ceased. Thirteen fish were captured around 11 a.m. from the breeding rapids, out of which 8 were females and 5 males — all between 72-96 mm length range. The females were dissected in the field itself and all of them showed fully spent ovaries, thus emphasizing the fact that they had shed all the matured ova in one burst of spawning.

Eggs were highly adhesive and heavily yolked, and demersal. They adhered to the sides of the rocks and submerged decaying vegetation such as leaves and twigs; thus they were not likely to be washed down by the flowing water. When a few boulders were lifted in the evening around 4 p.m., hundreds of eggs were found to have been laid by the fishes in trough-like depressions carved out of the mud. Though 95% eggs were found to be fertilized, 5% appeared whitish (obviously unfertilized). Eggs were collected at different intervals after spawning.

On the early morning of 19th January 1978 it was surprising to find that the rapid in which spawning was observed on the previous day, no water found and the entire water had probably drained down to the neighbouring smaller crevices on the rocky terrain. This exposed the

entire bottom of the rapid to the atmosphere. The whole area was however wet and the underlying mud and sand held a good amount of water, thus not allowing the bottom to dry up. When the decaying vegetation and boulders were removed, it was a pleasant surprise to find that the hundreds of eggs lying beneath them had well developed embryos, which showed normal movements. A good harvest of embryos was made. The eggs showed a high degree of adhesiveness and clumped together when held in the hand. Eggs with live embryos were

taken from the rapid along with some stream water and detritus, and were brought to the laboratory. They were left inside large, well-aerated tanks to observe their further development. Unfortunately they survived for only a few hours.

ACKNOWLEDGEMENTS

One of us (L.J.) is grateful to Mr. M. Maruthanathan for accompanying him throughout the work at Ulakkaruvi in spite of the hardships of travel in the hills.

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